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DEFECTS IN GLAZING OF CONCRETE ARTICLES

Yu. A. Shchepochkina[1]

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The reasons for the origin of the most common defects in glazing of concrete (ferroconcrete) articles are considered, and possible methods for preventing these defects are specified.

Glazing of concrete (ferroconcrete) articles may cause the formation of a number of defects [1] that impair their quality. The defects in concrete articles usually have other origin than similar defects in glazing ceramics. Therefore, in glazing concrete, the typical methods for prevention of defects [2] are not always acceptable.

As distinct from glazing of ceramics, the glaze treatment of concrete articles has certain specifics.

First, the surface of a concrete article is heterogeneous and has a granular texture and roughness. It is noted in [1] that a melted glaze mixture in glazing fills well the macro- and micro-irregularities of the surface relief up to hollows of 3 – 5 μm. Certain microsites of the open underglaze layer, mostly in the form of pinholes sized 0.1 – 1.5 mm, do not disturb the agreeable granular texture of the glaze surface [1]. However, practical experience shows that such state of the surface is one of the reasons for the origin of defects in the coating in the form of small hollows.

Second, articles in heating release water vapor due to dehydration and also gases sorbed in the surface of the concrete pores [3]. The released gaseous components produce swelling of glaze (up to 5 mm in diameter) and the formation of small bubbles on the glaze surface.

Third, due to the disturbance of the material structure in heating and its loosening, the surface layer (up to 10 mm) of the article expands (0.9 – 1.1%), which causes the formation of microcracks. Therefore, it is important to ensure the compatibility of the TCLEs of the glaze and the article surface.

It is known that the TCLE of glaze in a perfect case should correspond to the TCLE of the material glazed. However in glazing concrete articles, one can accept the TCLE of glaze to be slighter lower in view of the expansion of the surface layer of the article. This is corroborated by experiments to test the compatibility of the TCLE ($76.22 \times 10^{-7}\ K^{-1}$) of glaze and the TCLE of samples made of a cement-sand mixture according to the plate method (without a hollow in the central part) [4, 5]. The plates in glazing become slightly deflected; however, after thermal treatment their surface appears to straighten due to expansion. The surface deflection on a glaze concrete sample of substantial thickness is insignificant and visually almost imperceptible.

The possibility of using glazes whose TCLE is lower than the TCLE of the material glazed is noted in [1], where it is demonstrated that the permissible interval for the TCLE of glaze and the glazed material is wider than in glazing of ceramics; in particular, with the TCLE of a glazed material equal to $(75.0 – 80.0) \times 10^{-7}\ K^{-1}$, the acceptable TCLE for the glaze lies within the limits of $(50.0 – 100.0) \times 10^{-7}\ K^{-1}$. According to V. K. Kanaev [1], this is due to the fact that the coating in glazing does not spread on the underglaze surface in the form of a regular layer of equal thickness as in glazing ceramics, but has a granular texture with numerous relief irregularities and occasional unglazed spots.

This opinion appears valid. Indeed, the quality and the texture of the glazed surface play a significant role. However, in our opinion, the main reason is related to the expansion of the surface layer of the glazed material, and unless this factor is taken into account, serious defects may arise in glazing concrete articles.

The most common defect in glazing concrete articles is shivering of glaze, which has a significant effect on the strength of the coating adhesion to the glaze material and is directly related to the state of the surface of the article. It is noted in [2] that the defect of shivering consists in the disturbance of the continuity of glaze, when glaze becomes aggregated in drops and some sites of the surface remain uncoated.

One of the reasons for the lack of continuity of a glaze layer is the presence of sites of the article surface that are not wetted with the glaze suspension. As a method for prevent-

[1] Ivanovo State Construction-and-Architectural Academy, Ivanovo, Russia.

TABLE 1

Defect*	Reason of origin	Proposed method of prevention
Glaze shivering, glaze dryness (gap), bald spots	Uneven, heterogeneous, contaminated surface	Dividing the article surface into "mircozones," thorough cleaning of molds for making articles, cleaning of the surface intended for glazing from contamination
Glaze blistering, bubble, pimple	Increased moisture of the surface, release of water vapor in heating	Glazing articles not earlier than 28 days after their production; in the case of excessive moisture drying the surface at a temperature above 35°C
Pinholes	Presence of point holes on the surface	Thorough cleaning of molds for making articles, increasing the mobility of the concrete mixture
Clogging	Protracting filler grains on the surface of the article or extraneous inclusions fixed in the surface	Thorough cleaning of molds for making articles, adequate compaction of the concrete mixture
Burn-out	Presence of an extraneous body fixed on the surface	Removal of the extraneous body and subsequent homogenizing of the surface with a cement-sand mixture
Uneven tinting of glaze	Contamination of glaze with cement dust during its deposition	Purification of the surface of the article, increasing the temperature and duration of fusion of the glaze coating
Agglutination	Penetration of glaze suspension onto surfaces not intended for glazing (lateral surfaces of the articles)	Purification of the lateral surfaces from the glaze suspension
Chipping off, chinks, cracks	Mechanical damage of articles in transportation and storage	Avoiding placement of one glazed article on top of another
Spots	Contamination of the surface of the article	Purification of the article surface, introducing a decolorizing agent in the glaze suspension
Crackle	Nonuniform cooling of glazed articles, lack of compatibility between the TCLE of the glaze and the article	Heat insulation of glaze articles, coordination of the TCLE of the materials
Notches	Expansion of the surface layer of the article in heating	Uniform heating in glazing

* Defect definitions correspond to B GOST 13996–93.

ing this specific defect, it is advisable to divide the surface into "microsites" (with a side not more than 2 mm). Such division of the surface can be implemented, for instance, by applying a grid (metal, nylon) on the surface of as yet unsolidified concrete article intended for glazing. Penetrating into such microsites, the glaze suspension will fill them all, not leaving unwetted sites. The division of the surface into microsites is also acceptable for the prevention of some other defects (dryness, bald spots).

The reasons for the origin and the methods for preventing some of the most common defects in glazing concrete articles are listed in Table 1.

The use of these methods for preventing defects will make it possible to improve the quality of glazed concrete articles and to correct the technological procedures of glazing.

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